

## RURAL MEASURES

A central purpose of this project is to identify factors for distinguishing rural and non-rural populations in Alaska. A number of variables were identified for inclusion in project databases for examination as potential factors, listed in Appendix A. The list contains the variable name, variable description, data source, and notes. Values of variables are contained in the PACK Database, which accompanies this report as a separate file in the documentation. The main sources of variables include the U.S. Census, 1990; U.S. Census, 2000; Community Profile Database (CPDB) of the Alaska Department of Fish and Game; the harvest ticket/permit records of the Alaska Department of Fish and Game; and the Alaska Department of Community and Economic Development (DCED).

Variables from the CPDB primarily derive from household surveys from a sample of Alaska communities and years, augmented with Alaska Department of Labor population information. Variables from the U.S. Census derive from decennial household surveys. Harvest ticket/permit records pertain to individuals or households harvesting under state licenses and permits. Variables from the DCED database derive from a variety of secondary sources. In addition to these pre-existing variable sets, new variables have been constructed for analysis from this information, as identified in Appendix A.

Because of their different sources, variables pertain to a variety of survey populations and years. For instance, while information from the CPDB pertains to *community populations* during a survey year, federal census information pertains to a hierarchy of *federal census unit populations* (tracts, census designated places, and so forth). In the construction of our databases, information was matched to a common set of population units when feasible, as discussed in a following section, *Aggregation/Disaggregation of Populations*. This was intended to allow for statistical analysis and model building with a consistent set of Alaska populations. As shown in Appendix A, there are a number of variables that serve as identifiers of population units (e.g., PACNAME, PACNOTE, and PACTYPE). The identifiers name both a population group and, in most cases, a bounded geographic area which may be located on maps.

Variables listed in Appendix A are ordered by general type – demographic (e.g., population size, population density), economic (e.g., country food procurement and use, location of economic-administrative networks, economic activity), cultural (e.g., prevalence of sport traditions, differentiation of knowledge of Nature), and landscape and community infrastructure (e.g., roads, households with full plumbing). Variables are potential measures within the general type.

According to this study's RFP (p. 8), an overriding goal is to use a minimal number of criteria that can clearly, effectively, and defensibly distinguish between rural and non-rural populations. The RFP also specifies that measures be drawn from the U.S. Census and the Alaska Department of Fish and Game harvest records, among other sources (see RFP p. 8). Building on the above general concepts, the following two measures of primary rural concepts were developed for use in identifying rural/non-rural populations:

## I. Primary Rural Concept. *Extensive Land Use*

*Criterion:* Country Food Production

*Variable:* Annual per capita harvests of country food.

*Description:* This is a measure of the quantities of country foods harvested for local consumption within a population. It is an index created from multiple measurements from surveyed households or respondents. Information on harvests of individual fish and wildlife categories is collected, compiled, and combined into a single index. As such, it is a more sensitive measure of country food production than one developed from a single species or species group. Harvests within a population are converted to standard weights (usable lbs), summed, and divided by the population size. Harvests are expressed in terms of lbs and their nutritional content (percentage of the Recommended Dietary Allowance for protein). The measure is for a single year. A log transformation of the index is used in certain statistical analyses.

*Source Data:* There are two information sources for constructing the index. The Community Profile Database (CPDB) of the Alaska Department of Fish and Game (ADF&G) provides household survey information for surveyed Alaska communities. The Harvest Ticket/Permit Records of ADF&G provide harvest information from non-commercial net fisheries, hook-and-line fisheries, and hunts of large land mammals that require a permit or license.

## II. Primary Rural Concept. *Sparsely-Populated, Open Country*

*Criterion:* Density of Population to a Local Commons

*Variable:* Weighted population within a standard area.

*Description:* This is a measure of the numbers of people living within a standard area surrounding a case population, weighted by distance from the origin population. In our study, the variable was assessed using three distances – 10 miles, 20 miles, and 30 miles. The 30-mile distance, representing a generous daily commute distance, was chosen as the standard. Origin and vicinity populations are measured at the level of either census tracts or census designated places, whichever unit provides a finer resolution for a population, except for a few cases where census block units of comparable size are used. The measure pertains to the year 2000. A log transformation of the measure is used in certain statistical analyses.

*Source:* The 2000 United States census is the source for information on population sizes and geographic locations (centroids) of census unit populations. The measure is calculated using a geographic information system for areas with population concentrations, or estimated without a GIS program for dispersed settlements.

The measures for these primary concepts were developed specifically for the project using federal census and ADF&G materials. As shown below, the measures were found to effectively distinguish between rural and non-rural populations. Understanding the construction of these measures is useful for understanding the rural/non-rural assessment methodologies in the next section, so each measure is highlighted here.

## Country Food Production Measures

Production of “country foods” was identified in the literature review as a central indicator of rural areas. Country food production is directly related to the core meaning of “rural” as areas of *extensive land uses*, particularly areas of *primary food production (farming, etc.)*. Primary food production generally occurs in rural areas as occupations of segments of rural populations. In Alaska, country food production is a major land use in rural areas. Rural populations produce more country foods than urban populations as a general rule. Rural populations may be engaged in other extensive land uses as well, such as commercial fishing, trapping, logging, and mining.

Country food production has been systematically measured across many Alaska populations. Standard estimates of country food production for noncommercial use are available in the CPDB for residents of many small and mid-sized communities. For our project, information in the CPDB was extracted to create estimates of country food production by surveyed Alaska communities (such as ADJPCAP and PERCAP1) (Appendix A).

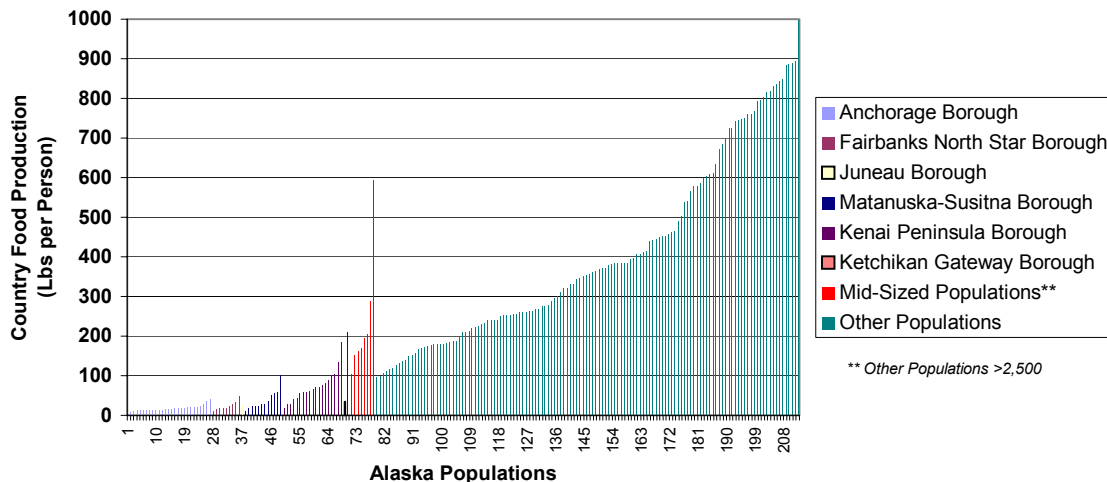
Unfortunately, the CPDB lacks harvest information for many of Alaska’s large population centers. For statistical analysis comparing rural and non-rural populations, measures of country food production in the larger cities were needed from sources other than the CPDB. For this project, estimates were developed from other harvest ticket/permit records databases in ADF&G to meet this data need in the large population centers.

For this study, estimates of country food production were developed for populations in the City and Borough of Anchorage, the Matanuska-Susitna Borough, the City and Borough of Juneau, the Fairbanks North Star Borough, the Ketchikan Gateway Borough, and the Kenai Peninsula Borough. These areas contain somewhat more than three-quarter’s of Alaska’s population. Information on annual harvests of major food species by these populations is available in several ADF&G data sources, including the Alaska Subsistence Fisheries Database (subsistence or personal use salmon net fisheries), big game harvest ticket/permit records (bison, brown bear, black bear, caribou, deer, elk, goat, moose, musk-oxen, and sheep), and sport angler records (salmon, halibut, trout, and other sport species). These ticket/permit record systems are assumed by the State to provide a relatively complete picture of harvests of major food species in Alaska’s large population centers. Participation in the ticket/permit systems is thought to be relatively good in the larger communities. Response rates on post-season mailed harvest surveys are also considered satisfactory for depicting harvests in the large population centers.

To estimate country food harvests in these areas, harvest ticket/permit records were compiled and matched to specific populations using ZIP codes (mailing address) or the community of residence. This process is described more completely in the section, *Aggregation/Disaggregation of Populations*. Harvests were converted to standard weights and divided by population size. Through these procedures, per capita wild food

production levels were estimated for tracts and CDPs in the population centers where CPDB household survey information was unavailable.

**Fig. 8. Country Food Production (Lbs per Person) by 212 Alaska Populations Grouped by Borough**

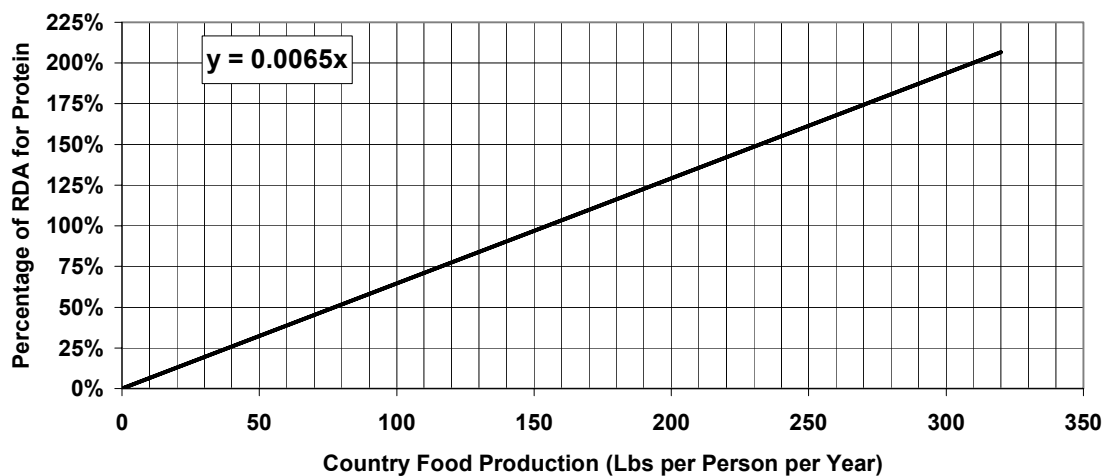


Country food production levels (lbs per person per year) are illustrated for 212 Alaska populations in Fig. 8. In this figure, populations are grouped by borough, to illustrate the variation in production levels by geographic area. The lowest production of country food (generally below 50 lbs per person) occurs in populations of the Anchorage Borough, Fairbanks North Star Borough, Juneau Borough, and Matanuska-Susitna Borough (left side of Fig. 8). Country food production by populations of the Kenai Peninsula Borough and Ketchikan Gateway Borough is generally below 75 lbs per person, but ranges as high as about 200 lbs per person in certain places. Mid-sized communities (>2,500 people) in other boroughs produce country foods at levels ranging from about 100 to 300 lbs per person. Country food production in other Alaska communities outside these areas generally are above 100 lbs per person, with levels between 200 to 600 lbs per person common.

Country food production estimates raise validity issues in certain areas. We assumed that the CPDB provided reasonable estimates of country food production for small to mid-sized communities. We also assumed that the harvest ticket/permit records provided reasonable estimates of country food production for the large population centers where CPDB surveys were unavailable (Municipality of Anchorage, Fairbanks North Star Borough, Matanuska-Susitna Borough, City and Borough of Juneau, and the Ketchikan Gateway Borough). For the Kenai Peninsula Borough, dual estimates of country food production were available for certain populations (Cooper Landing, Fritz Creek, Homer, Hope, Kenai, Nikolaevsk, Ninilchik, North Fork Road, and Vosnesenka). For these populations, estimates from household surveys in the CPDB were usually somewhat greater than estimates from the harvest ticket/permit records. Reasons for the discrepancies were uncertain. However, we suspect that sampling effects due to substantial non-response rates to face-to-face and mailed surveys by Kenai populations

may be related to differences. For populations in the Kenai area with dual harvest estimates, we conducted separate statistical runs using CPDB estimates and using harvest ticket/permit record estimates. These outcomes are compared in Appendix B. In our “best analysis,” we averaged the two harvest estimates for these cases. It would be useful if future research might resolve these questions of country food measures in the Kenai Borough populations. More precise estimates for country food production in Kenai Borough populations would be useful, based on household samples without substantial non-response rates.

**Fig. 9. Country Food Production Levels and Protein Content  
(Percentage RDA for Protein) in Alaska**



Country food production levels were expressed as lbs per person per year in the discriminant analysis assessment. This is a standard measure found in the CPDB. In the criterion-referenced assessment, country food production levels were expressed in terms of nutritional values – the percentage of a population’s Recommended Dietary Allowance (RDA) for protein contained in the country food harvest. This is also a standard measure in the CPDB. Its calculation assumes an average of 115.7 g of protein per lb of country food and an RDA for protein of 49 g per person per day for an Alaska population. For country food production in Alaska populations, the relationship between lbs and protein content is expressed by the equation,  $y = 0.0065x$ , where  $y$  is the percentage of the RDA for protein contained in the country food harvest, and  $x$  is the country food harvests expressed as lbs per person per year. The statistical relationship is illustrated in Fig. 9. This relationship was used in the definition of threshold standards for country food production, as is described below.

## Density Measures

Population density was identified in the literature review as a potential indicator of “rural.” Population density is directly related to the core meaning of “rural” as *open country*. Rural areas are less dense than urban areas. The lower densities of rural areas give the sense of “open space” indicative of “the country.” For some government purposes, density is used to classify areas as “rural” or “urban.” For instance, the U.S. Census Bureau defines an “urbanized area” as an area consisting of a central place and adjacent territory with a population density of at least 1,000 people per sq mi of land area that together have a minimum residential population of at least 50,000 people.

What density values may distinguish between rural and non-rural Alaska areas are empirical questions. The answers are dependent in part on the types of people-to-land relationships found in Alaska, and in part on how densities are measured. Alaska populations of similar sizes, living in census units with similar geographic areas (sq mi), may exhibit substantially different densities to their land base. This is because the residents of some census units regularly use extensive unpopulated lands and waters beyond their census unit boundaries, a common village pattern for producing country foods described in the literature review. By contrast, residents of other census units regularly use populated areas outside their census unit boundaries, a common metropolitan use area pattern. The first pattern is more country-oriented than the second. These distinctions can be captured by properly-constructed density measures.

A new density variable (DNSDUA) was constructed from federal census information to provide measures of people-to-land base relationships in Alaska. DNSDUA is a variable measuring the *density of people in a standard daily use area*. It is a measure of the people living in nearby surrounding areas that are potentially used on a daily basis (a local commons). It is defined as the sum of the weighted populations within a standard distance of one’s residence. That is, DNSDUA counts the people within a standard area, weighted by distance. DNSDUA was calculated for three standard distances and areas – a 10-mile distance representing a 314 sq mi area (DNSDUA10), a 20-mile distance representing a 1,256 sq mi area (DNSDUA20), and a 30-mile distance representing a 2,826 sq mi area (DNSDUA30). This was done to examine the performance of the measure at each of the three distances. In our statistical analysis, the 30-mile standard area performed best at distinguishing populations and so was chosen as our standard (DNSDUA30). However, all three variables were fairly similar to one another in relative density values and performance.

The data source for the numbers used in calculating DNSDUA was the federal census (2000). The federal census provides estimates of the numbers of people by census unit. To calculate DNSDUA, we used census tract populations or census designated place populations (CDPs), whichever provided finer resolution for an area (see the discussion of aggregation/disaggregation). Rarely, census blocks were used to achieve units of comparable size (e.g., Sitka). The federal census provides a central geographic point for each census tract or CDP, called a *centroid*, which was used to estimate the locations of

populations. Occasionally, for a few large census tracts, we adjusted the geographic centroid within the tract to better represent the actual location of a tract's population. For close, multi-tract areas, we used a computer program (ArcView GIS) to identify populations within the standard 30-mile distance from the centroid of a case population. For more remote villages, we used approximations of DNSDUA without the ArcView GIS program, because of project labor constraints. The density estimates for remote villages are close to actual values; however, these density estimates could be refined slightly by using an ArcView GIS program.

To calculate DNSDUA30, the weighted population within 30 miles of the centroid of a case population was divided by 2,826 sq mi (the area of a circle with a radius of 30 miles). For weighting, populations within 30 miles of the centroid were divided by the distance of the population from the centroid. Weighting was used to represent decreasing population influences related to distance. It factors in the declining "presence" of neighbors at greater distances. The potential degree of crowding lessens with distance.

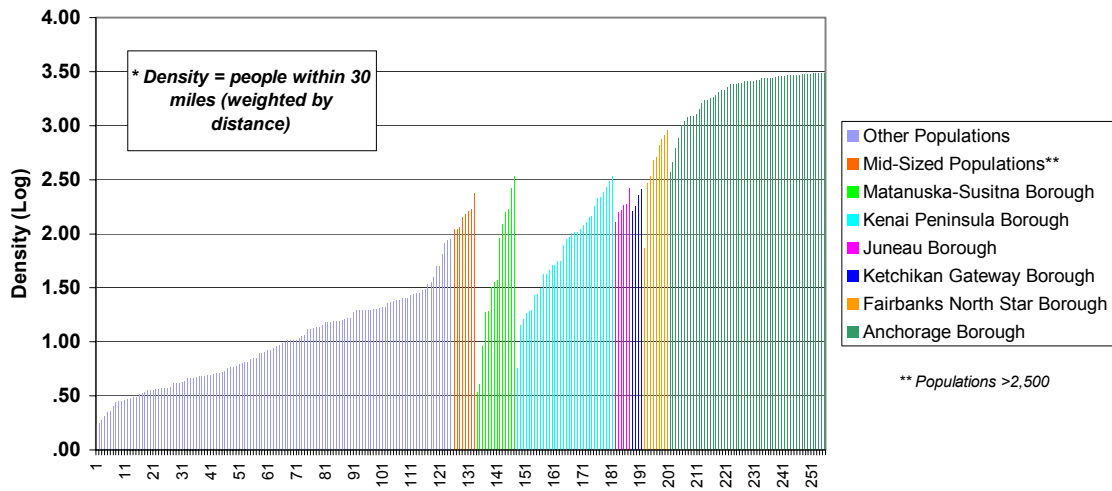
An example of this weighting procedure is illustrated in the following table, *Calculation of Tract 101 Density*. The example is for Tract 101 in the City and Borough of Anchorage (this tract contains Eklutna). The ArcView GIS identified 36 tracts within 30 miles of Tract 101, partially listed in the table with their populations and distances. To calculate weighted populations, a tract's population was divided by the distance of its centroid from the origin population's centroid. For example, Tract 102 with a population of 4,472 people was divided by 14.0 because its centroid is 14 miles away from the Tract 101's centroid, giving it a weighted population of 319.7. Tract 201 with a population of 3,060 people was divided by 20.9 because it is 20.9 miles away from Tract 101, for a weighted population of 146.5. This was done for all populations within the 30-mile standard area. The weighted populations were summed, totaling 8,068.3. This sum was added to the number of people in Tract 101 (4,805 people), which has a weighting of "one" because it is the origin, for a total of 12,903.3 weighted people. This was divided by 2,826 sq mi (the standard area) to produce a value of 4.6 weighted people per sq mi (DNSDUA30).

Calculation of Tract 101 Density			
Tract	Distance	Population	
		Unweighted	Weighted
102	14.0	4,472	319.7
201	20.9	3,060	146.5
202	19.5	5,924	303.6
203	18.6	9,165	492.8
204	9.3	2,461	264.4
↓	↓	↓	↓
Tracts (30-Mile)		206,450	8,068.3
101		4,835	4,835.0
Total			12,903.3
Standard Area (30 Miles)			2,826
Density in 30-Mile Distance			4.6

DNSDUA has several potential advantages as a measure of density. All populations receive consistent treatment using a standard distance (by contrast, densities within census unit boundaries show marked inconsistencies linked to variability between bounded areas). While 30 miles is selected (equivalent to a generous daily travel distance), other distances might be used for the density measure as long as they are consistently applied across populations. With DNSDUA, all populations within the standard distance are captured by the density measure (by contrast, densities within census unit boundaries ignore populations outside unit boundaries). DNSDUA has an intuitive interpretation – it is a measure of the people living within a standard distance from a person’s home. As such, it is a measure of “openness” within a surrounding area (a potential daily use area, a local commons surrounding a community). Economic activities by a person generally are within a daily travel distance. The types of economic activities conducted by a person, particularly land uses, are influenced the congestion of people in the surrounding commons. As will be shown in our analysis, there is a strong statistical association between the density of people in one’s standard use areas and the productivity of country foods in Alaska. This statistical association is a basis for distinguishing between rural and non-rural populations.



**Fig. 10. Densities\* of Standard Use Areas of 255 Populations Grouped by Borough**



The values of DENSUA30 for 255 populations grouped by borough are illustrated in Fig. 10, expressed as a log value (see also Fig. 18, for non-log values). By this measure, the greatest densities within a standard daily use area are found for populations in the Anchorage Borough, Fairbanks North Star Borough, Ketchikan Gateway Borough, and Juneau Borough (right side of Fig. 10). The lowest densities are displayed by Alaska village populations (left side of the Fig. 10). Densities for populations in the Matanuska-Susitna Borough and the Kenai Peninsula Borough display a substantial range, but primarily fall toward the middle of values in this selection of places.

